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DRAWINGS ATTACHED.

Inventor:—KEITH DILLON HARRIS.

1,128,162

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COMPLETE SPECIFICATION.

Improvements in or relating to Lasers.

We, G. & E. BRADLEY LIMITED, a British Company, of Electrical House, Neasden Lane, London, N.W.10, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to lasers.

To achieve laser action in a Fabry-Perot cavity using plane reflectors, the reflectors must be maintained parallel within small tolerances. The use of a confocal system permits somewhat larger tolerances. The Brewster-angle windows described by W. W. Rigrod, H. Kogelnik, D. J. Brangaocio and D. R. Herriott at pages 743-744 of Volume 33 of the Journal of Applied Physics enable reflectors to be placed outside a gaseous-laser envelope thus facilitating the aligning of the reflectors.

A further improvement results from totally internally reflecting corner prisms used as described by Z. Godzinski at Page 361 of Volume 51 of the Proceedings of the Institute of Electrical and Electronics Engineers.

A corner prism is characterised in that three of its four faces are mutually perpendicular, as are the faces at a corner of a rectangular block. These three faces are hereinafter called corner faces. The edges formed by the intersections of the corner faces with one another, and hereinafter called corner edges, are usually of equal length. The remaining face of the prism will be referred to herein as the refracting face.

Successive reflections at the three corner faces of a corner prism deviates a ray through 180° irrespectively of the angle of incidence of the ray at the refracting face of the prism, thereby removing the need for strict alignment of such prisms when used as reflectors for lasers.

In a gaseous laser suggested by Z. Godzinski, a corner prism is so oriented that the axis of the laser is normal to the refracting face of the prism. The term "the axis of the laser" is used throughout this specification to refer to the line which passes through the geometric centre of the laser material and is parallel to the direction substantially defining the direction of propagation of stimulated radiation in the laser. The corner prism has corner edges of equal length and is outside the envelope of the laser, the ends of the envelope being formed by Brewster-angle windows. Reflection at the refracting face can be reduced by the application thereto of a non-reflecting coating.

According to the present invention there is provided a laser including a container enclosing the laser material and being closed at one end by a prism, the laser material being fluid and the prism providing, in operation, total internal reflection of stimulated radiation incident upon its refracting face from the laser material and having its refracting face inclined to the direction in which the said radiation is, in operation, incident thereupon and emergent therefrom, the angle of inclination being the complement to the Brewster angle. Thus the need for applying a non-reflecting coating to the refracting face is avoided. Furthermore as the refracting face of the prism is in direct contact with the laser material dust is prevented from reaching the refracting face. In a gaseous laser, therefore, the need for Brewster-angle windows can be avoided.

The invention will now be described by way of example with reference to the ac-

companying drawings in which the sole Figure is a simplified sectional view of part of an embodiment of the invention.

In Figure 1 there is shown in Section the optical cavity of an embodiment in which the laser material is gaseous, one end of a glass envelope 10 containing the laser gas being so cut that the rim formed lies in a plane with which the axis 11 of the laser makes an acute angle α which is the complement of the Brewster angle in the laser gas with respect to the material of a corner prism 12. The corner prism 12 is so cut that the angle β between the plane of its refracting face 13 and the line 14 which passes through the point of intersection 15 of the corner edges and is equally inclined to the corner edges is equal to the said Brewster angle. The refracting face 13 of the corner prism 12 is sealed to the rim by sintering after lapping. The material of the corner prism 12 is chosen to absorb as little as possible of the laser light while remaining consistent with the requirements that total internal reflection take place.

The other end of the glass envelope 10 is cut in the same manner and an identical corner prism 16 sealed to the rim formed.

An output from the optical cavity can be obtained from one of the corner faces 17 of the corner prism 16 by frustrating total internal reflection at that face. Alternatively an output can be obtained by utilizing the residual reflection from the refracting face of one of the corner prisms.

A prism 18 is placed with one of its faces 19 close to the corner face 17 of the corner prism 16. The refractive index of the material of the prism 18 is such that total internal reflection at the corner face 17 is frustrated provided that the face 19 is sufficiently close to it.

In other embodiments in which the laser material is either a gaseous or liquid the prism can be sealed to the container of the laser material by means of a suitable adhesive; for example, where the container is glass, an epoxy resin may be used.

It will be obvious to those skilled in the art that prisms other than corner prisms can be used in embodiments of the present invention.

WHAT WE CLAIM IS:—

1. A laser including a container enclosing the laser material and being closed at one end by a prism, the laser material being fluid and the prism providing, in operation, total internal reflection of stimulated radiation incident upon its refracting face from the laser material and having its refracting face inclined to the direction in which the said radiation is, in operation, incident thereupon and emergent therefrom, the angle of inclination being the complement to the Brewster angle.

2. A laser according to Claim 1, wherein the laser material is gaseous, the container being closed at the other end by a further prism providing, in operation, total internal reflection of stimulated radiation incident upon its refracting face from the laser material and the refracting face is inclined to the direction in which the said radiation is, in operation, incident thereupon, and emergent therefrom, the angle of inclination being the complement to the Brewster angle.

3. A laser according to Claim 1 or 2, wherein one of the said prisms or the said prism is provided with means for frustrating total internal refraction at one of its faces not being its refracting face, whereby an output can be obtained from the laser.

4. A laser according to any one of the preceding Claims, wherein at least one of the prisms is a corner prism.

5. A laser having an optical cavity as described hereinbefore with reference to Figure 1 of the accompanying drawings.

REDDIE & GROSE,
Agents for the Applicants,
6 Bream's Buildings,
London, E.C.4.

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1128162 COMPLETE SPECIFICATION
1 SHEET This drawing is a reproduction of the Original on a reduced scale

Fig. 1.